



United States Department of Energy
Nuclear Criticality Safety Program (NCSP)

1-Week Nuclear Criticality Safety Manager Training Course

Student Information Booklet

Fiscal Year 2016



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Course Description

This course is designed for Managers with NCS responsibilities, Fissile Material Operators, Regulatory Personnel and Process supervisors. The course is one-week long and is offered at two locations: the National Critical Experiment Research Center (NCERC) and Sandia National Laboratory (SNL). The purpose of this course is to provide an experimental hands-on training experience addressing important characteristics of neutron-multiplying systems, which will include: awareness of fissile material in process operations, along with discussion of the theory and implications for safety of fissionable material operations; awareness and understanding of DOE mandates developed specifically for fissile material operators, process supervisors, and managers with NCS responsibilities, regarding application of DOE Orders, Guides, Rules, ANS standards in performance of criticality safety evaluations that meet DOE standards and hazards analysis methods and implementation/maintenance of NCS controls, with respect to the roles and responsibilities of all those who are involved. A course flier for the 1-week Manager courses can be downloaded from this location: http://ncsp.llnl.gov/HS3201/TEP-poster-36x48-2013_1_week_course_FINAL-r2.pdf.

A diverse team of instructors, experimenters, and coordinators participate in the conduct of these courses. Individuals from Oak Ridge National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratory, National Nuclear Security Administration, Los Alamos National Laboratory, and National Security Technologies, LLC, currently participate in the course planning and execution.

Course Schedule

The Manager training with critical assemblies will depend upon your registration choice and clearance level. L- and Q-cleared students can attend the Sandia Hands-on course located at Technical Area 5 at Sandia National Laboratory. Q-cleared students can attend the Hands-on Training at the National Critical Experiment Research Center (NCERC) located at the Device Assembly Facility (DAF) at the Nevada Nuclear Security Site (NNSS), located approximately 65 miles from Las Vegas, NV. Both Manager courses are conducted Monday through Friday from about 8 am to 5 pm.

Course Content

The content of the NCERC/DAF and Sandia Manager courses are similar in nature, although the lectures are based on the types of critical assemblies at the location. The course content for each course is provided below.

NCERC/DAF Manager Course

- Review of NCS fundamentals
- Criticality safety standards and DOE regulations
- DOE requirements, national standards, and overview of the DOE Nuclear Criticality Safety Program
- Overview of DOE-STD-3007 and an overview of criticality safety evaluation content
- Experimental methodology introduction
- Training Assembly for Criticality Safety (TACS) experimental methodology
- TACS subcritical experiments

- Overview of reactor physics
- Planet subcritical hand-stacking experimental methodology
- Planet Hands-on operations and approach to critical and critical operations
- Advanced hands-on demonstration with the BeRP ball and the Np sphere
- Flattop critical operations
- Godiva IV critical assembly demonstration
- Review of experimental criticality accidents
- Human factors principles
- International Criticality Safety Benchmark Evaluation Project (ICSBEP) overview

Sandia Manager Course

- Review of NCS fundamentals
- Summary of process and experimental criticality accidents
- Overview of criticality safety evaluations and DOE-STD-3007
- Conduct of operations
- Design of the 7uPCX critical experiments
- Nuclear instrumentation
- Reactor kinetics
- Subcritical multiplication
- Nuclear criticality safety data and limits
- Overview of the ICSBEP
- Human factors principles
- ANSI/ANS-1 operations
- Criticality safety standards and DOE regulations
- Experiment 1-3 – approach to critical on fuel loading, moderator height and fuel separation
- Experiment 4 – Interior fuel rod removal

Completion Requirements

Attendees must complete and pass the Manager Course at SNL or NCERC/DAF with a grade of 80% or better. Certificates for successful completion of the course will be mailed to students after the course is completed. Participation is expected from all course attendees. Your grade includes each of the closed book exams on Friday (70% of grade) and participation throughout the week (30% of grade). Arrive on time and participate in class exercises to obtain all participation points. **PLEASE DO NOT PLAN TO LEAVE EARLY OR YOU WILL NOT RECEIVE A CERTIFICATE.**

Students can also provide feedback on all aspects of the course, including content, instructors, classroom characteristics, etc. Feedback is provided to the Course Coordinator who oversees student feedback resolution with the course points-of-contact.

Course Points-of-Contact

Contact information for the 1-week course is listed in the table below. Pre-course questions should be directed to Doug Bowen and Becca Hudson. Questions during the course can be directed to Doug, Becca or the course site points of contact.

Doug Bowen Course Coordinator	(505) 500-7686 (cell) (865) 576-0315 (office)	bowendg@ornl.gov
Becca Hudson Registration Point-of-Contact	(925) 422-6392 (office)	HUDSON14@llnl.gov
Mary Ellen Ratzner Sandia National Laboratory Class Point-of-Contact	(505) 844-2474	meratze@sandia.gov
Catherine Percher NCERC/DAF Class Point-of-Contact (Mon/Tues)	(925) 423-9345	percher1@llnl.gov
Theresa Cutler NCERC/DAF Class Point-of-Contact (Wed-Fri)	(505) 667-4795	tcutler@lanl.gov

Prerequisites

This course is designed for Managers with NCS responsibilities, Fissile Material Operators, Regulatory Personnel and Process supervisors.

Sandia Hands-on Training Prerequisites

Prior to obtaining unescorted access to TA-V at Sandia National Laboratories, the students must complete the following training modules prior to the course. Please submit the following information as soon as possible for processing.

- **ESH-100** – Please click on the URL link to open the following attachment, which contains both the course materials and the test.

➤ <http://ncsp.llnl.gov/HS3201/ESH100.pdf>

When you have completed reviewing the material and completed taking the test, print page 36 and fill in the information requested on the answer sheet:

- You are a visitor (where your org is requested)
 - The Sandia Training Coordinator providing this material is Mary Ellen Ratzer, Sandia Org. 1382.
 - Scan and email the completed test and feedback form to ESH100 Course Manager, Debra Maestas (dcmaest@sandia.gov) or fax to her at (505) 844-2748.
- **RAD102** – Please read the following document. The exam is found at the end of the document, pages 36-40. Please print these five pages, fill in your name and the required project task number (130493/09.02), complete the exam and either scan the exam and email to Tracy Armijo (tdarmij@sanda.gov) or fax to Tracy Armijo at (505) 844-2748.

➤ <http://ncsp.llnl.gov/HS3201/Rad102a.pdf>

- **Hazard, Emergency and Response Training (HEART)** – (Not done before the course) A video will be shown early on the first day of the class to present this training information. A short quiz will be provided afterward.

NCERC/DAF Hands-on Training Prerequisites

The NCERC/DAF hands-on training class requires students to handle significant quantities of fissionable material to participate in the hands-on portions of the class, e.g., Planet critical assembly uranium foil hand stacking, handling the plutonium BeRP ball, and Neptunium sphere. To come to the NNSS and handle our fissile material, we require that you have Radworker II training. For many people, this is the first time they have ever held large quantities of uranium and plutonium. Unless you are a fissile material handler at your home site, you probably are not allowed to go into a facility and pick up fissile material. Thus, each student is required to provide proof of Rad Worker II training with certificate of completion or training record. Currently, equivalency has been established for Radworker II for the following sites: LLNL, LANL, SNL, Pantex, Savannah River, PNNL, Y-12, ORNL, NFS, AMWTP Idaho, and INL. Send your proof of Rad Worker II training to Becka Hudson (HUDSON14@LLNL.GOV or fax 925-423-2854) so she can check/authorize equivalency and provide you with supplemental training (requires your signature), if needed.

Also, Nevada Test Site/NNSS access requires NNSS Site Access Safety Orientation, NNSS General Employee Radiation Training, Desert Tortoise Conservation Training, and Emergency Management Training (or a visitor briefing) prior to the course.

➤ <http://www2.nstec.com/Pages/Training/TrainingHome.aspx>

Site Specific Information

Sandia Hands-on Training Logistics

Meeting Location for Badge Enrollment

If your badge has not been enrolled in the Sandia system, you **MUST** go to IPOC (Innovation Parkway Office Complex) first. (From the Airport, take I-25 north to I-40 east to the Eubank exit. Turn right [south] to the end of Eubank – where Eubank makes a bend to the right [west] just before the base gate. Turn left on Innovation Pkwy, the light just before the gate. The road bends left [east] and then you turn left [north] into the lot in front of the building. Look for the sign for the Sandia Badge Office.) IPOC is located southeast of the Eubank gate. See the map at the end of this document for details on getting to the badge office. The badge office opens at 7:15 a.m. You will request to have your DOE badge put into the Sandia system. You will be asked to supply a 4-digit code in order to swipe your badge for access into limited areas.

Mary Ellen Ratzer will meet you at IPOC at 7:15 a.m. to assist with this process.

We will then proceed to the Eubank gate. Your DOE badge will get you through the gate. Take it out of the holder and pass it to the guard. They may check ID for everyone in the vehicle so be prepared if you have riders. The second map in this document shows you how to get to TA-V. Once you are on Pennsylvania, proceed until you see the sign to Tech Areas 3 and 5. Turn right there and proceed to TA-V. The parking lot is just beyond the main double-fenced area. For those so equipped, the lat./lon. of the

parking lot is 34 deg 59.959' -106 deg 32.247'. Building 6577 is east of the parking lot outside the fence. See the TA-V map (at the end of this document) for details on where to park and how to get to the training building.

When we are at the critical experiment facility, we will be in a Limited Area which requires an L or Q clearance for unescorted access. The emergency plan at the reactor facilities also requires that anyone who has not been trained on emergency response for TA-V be escorted for safety reasons while in TA-V. One of the first things we will do after your arrival is to provide that training so you can have unrestricted access to TA-V.

Prohibited Items at Sandia

As described above, during the class, we will be in a Limited Area (LA). As at all U.S. Department of Energy facilities, each area has a long list of items that are not allowed with the LA being the most restricted. Examples of prohibited items are listed below. Please be aware that **upon entering or leaving Sandia premises, all personnel are subject to search of their persons, hand-carried items, and vehicles.**

Items that are ALWAYS prohibited at Sandia:

- Firearms
- Explosives, pyrotechnics, propellants
- Illegal drugs & paraphernalia, intoxicants
- Other items prohibited by law

Examples of items prohibited in the Limited Area (e.g. during our operations at the critical experiments):

- Personally-owned electronic equipment
- Radio frequency transmitting equipment including Bluetooth devices, WiFi devices, and pagers with transmitters
- Recording equipment (audio, video, data)
- Computers and peripherals
- Removable computer media
- Cell phones or other cellular network devices
- Portable electronics including hand-held computing devices
- Non-Sandia owned devices

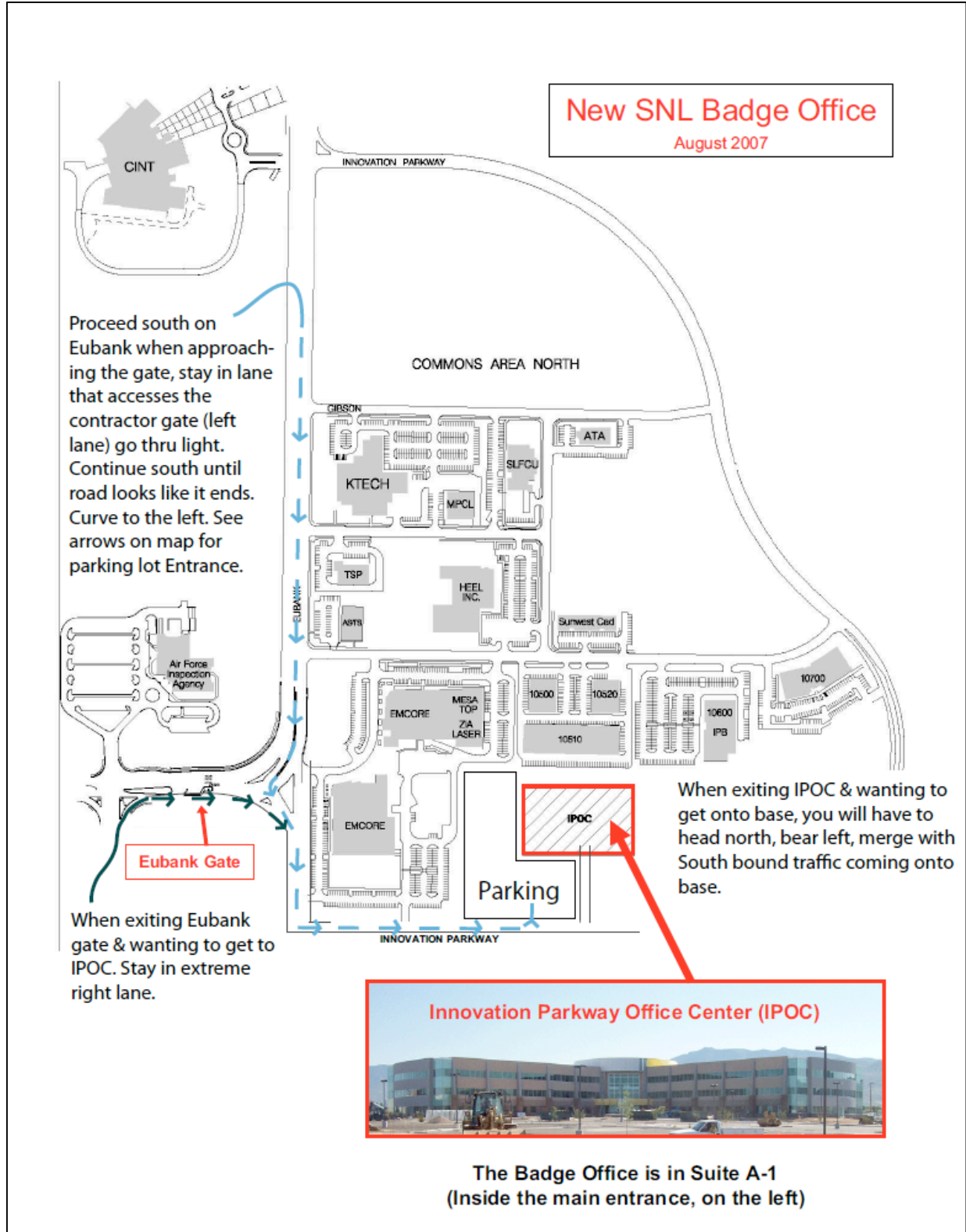
There is a lock box just inside the front door of Building 6577 that you can use.

Lodging and Dining in Albuquerque

SNL is located on Kirkland Air Force Base a few miles from the Albuquerque International Airport. A wide variety of hotels are available very close to the laboratory. The following website has recommendations for lodging and dining options in Albuquerque, NM:

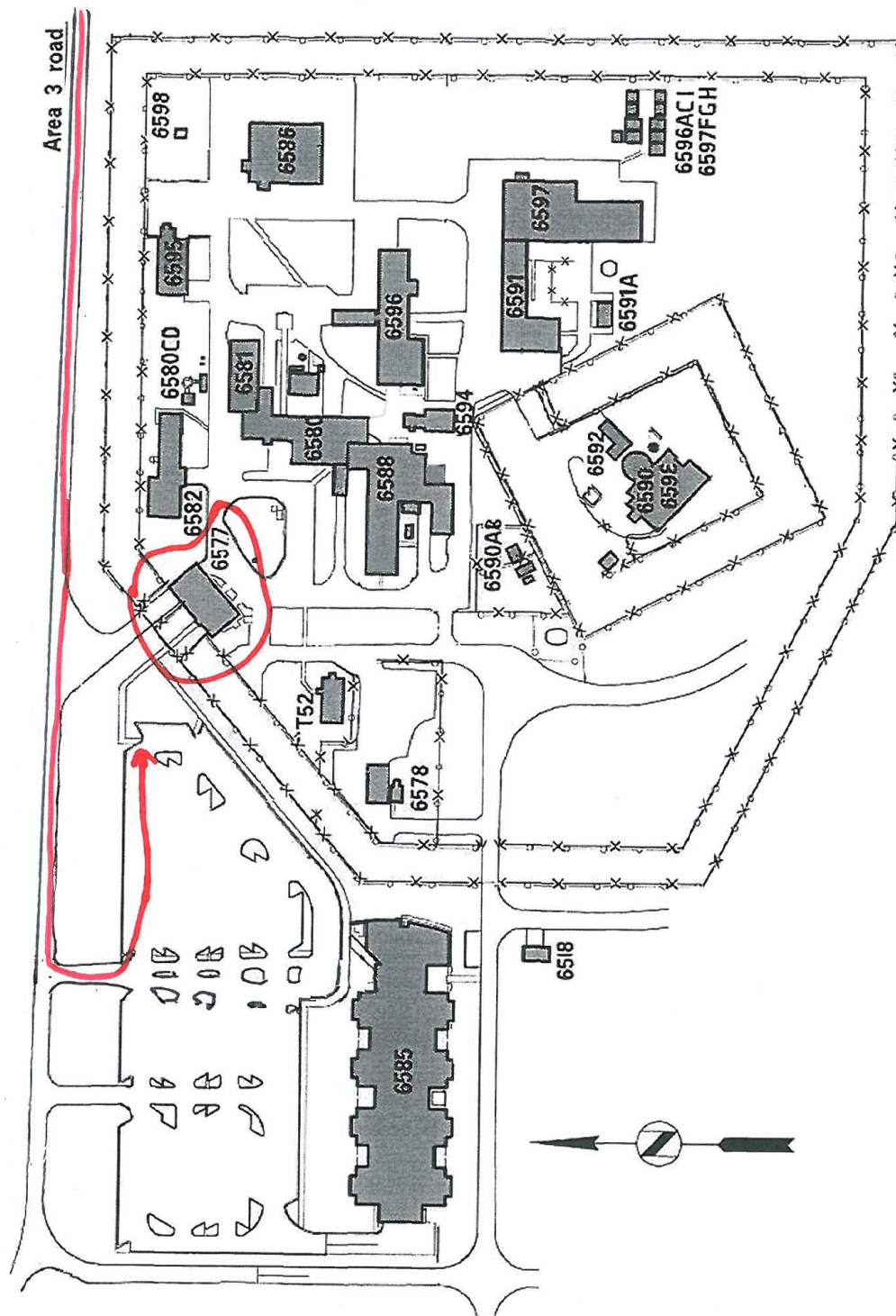
<http://www.itsatrip.org/lodging/default.aspx>.

Sandia Maps/Directions



Directions to the Sandia Badge Office

SNL — NM Area 5



Sandia Technical Area 5 Map

NCERC/DAF Hands-on Training Logistics

Location

NCERC/DAF is located on the Nevada National Security Site (NNSS). The NNSS is a DOE site, approximately the size of Rhode Island, located 65 miles northwest of Las Vegas, NV. The main base camp is Mercury, Nevada (searchable on Google maps).

NCERC/DAF is located in the Device Assembly Facility, a further 25 miles past Mercury on the site.

On Friday, we will be meeting in Las Vegas at the NFO in the NSF at 232 Energy Way, Las Vegas.

Cell Phones and the NNSS

Cell phones, even those with cameras, are allowed on the NNSS. However, no cell phones are allowed in DAF. Please leave cell phones in your car.

Prohibited Articles

Personal cameras (besides those in cell phones) are not allowed on the NNSS. You CANNOT use a camera to take photographs on the NNSS.

As with all DOE sites, illicit drugs, explosives, and firearms are prohibited.

Information on Things to Bring

- Your badge! If you forget your badge, you might miss out on a day or more of the class.
- A lunch for our experimental days (Monday, Tuesday, Wednesday, and Thursday)
- Money or credit card for lunch on Friday
- A calculator or laptop with spreadsheet software for homework (please leave in your car if you bring it onsite)

Badge Information

You will need a current HSPD-12 badge (the new federal credential) with a working magnetic strip (on the back) and gold chip (on the front). Contact your badge office if you have any questions about the functionality of your badge. You should test your badge to make sure both of these parts are working before coming to the NCERC/DAF class. If you do not have an HSPD-12 badge, or your badge does not work, let Becka Hudson (925-422-6392, HUDSON14@LLNL.GOV) know as soon as possible.

Dress Code

We will be in the DAF/NCERC Tuesday through Thursday. You need to wear long pants and sturdy shoes (tennis shoes, boots, or leather shoes) on lab days. If you have your own safety glasses with side shields, you may want to bring them for lab days.

If you are attending a class in the winter, the NNSS can be VERY cold in the early morning. Please make sure you bring a jacket.

Flight Information

The closest airport is Las Vegas McCarran International Airport (airport code LAS). You will need to fly in on Sunday (the day before the course starts) as the course will begin early on Monday morning. The course will conclude around noon on Friday. However, given travel time to the airport, rental car drop off, etc., the earliest time you want to reserve a return flight on Friday would be 6 pm.

Rental Car Information

A rental car is a must for attendance at the class. The NNSS is far from Las Vegas and you will need to drive. Most hotels in Las Vegas provide free parking (some provide free valet).

Driving on the Site

The NNSS has many interesting sites scattered throughout the desert, but as a visitor, you are not allowed to drive around site seeing. Please only drive on the Mercury highway to and from DAF. Do not attempt to drive off-road and do not pick up anything on the site to take for a souvenir.

You can be pulled over for speeding on the site. Obey all speed limits.

Driving Tips

The commute to and from the site will be long (see notes under “Lodging Information” for approximate travel times). There is spotty radio coverage on US-95, so you might want to bring CDs or an mp3 player and an auxiliary cable, especially for the early morning/late evening drives. Satellite radio is an option for your rental car, but is usually not a reimbursable additional expense for government travel. After the first day, you might consider car-pooling with your fellow students.

*******NOTE:** You will go through gasoline VERY quickly with a 150+ mile (round-trip) commute each day. There is NO gasoline available at the NNSS and the gas stations are few and far between on US-95. Keep an eye on your fuel levels!

*******NOTE:** Indian Springs is a small town (and one of the few gas station locations) you will have to pass through on your drive from Las Vegas to the site. This area is a HUGE speed trap, as you go from 70 mph down to **35 mph**. Many people visiting the NNSS have been pulled over for speeding here. Make sure you slow down when going through Indian Springs. On a brighter note, you will drive by Creech Air Force Base, home of both the predator drones and the Thunderbirds. If you're lucky, you just might get a free airshow during your commute to the site.

Lodging Information

Las Vegas

Las Vegas is usually the lodging location of choice for visitors to the NNSS. There are a plethora of hotels, entertainment, and dining options to choose from in Las Vegas. Many of the hotels offer rates below per diem (currently for FY2015 at \$96), although some do charge add-on “resort fees” (up to \$25/day) which may or may not be reimbursable by your travel department if they cause your lodging to be over per diem. The website www.vegas.com will allow you to easily compare rates at hotels in Las Vegas. Note that these rates DO NOT include the resort fees.

*****NOTE:** If you choose to stay on the Strip (Las Vegas Blvd), be aware that your travel time to Mercury is approximately 75 minutes (early morning, no traffic). Your travel time to DAF (Wednesday and Thursday mornings) from the Strip is approximately 100 minutes.

North Las Vegas

North Las Vegas is another option for lodging near NNSS. It is approximately 10 miles closer to the site than the Strip, and has many chain hotels (Marriott, Hampton Inn, La Quinta, etc). A popular hotel/casino with many NNSS regular visitors is the J.W. Marriott located on Summerlin Parkway. They do not charge resort fees and will typically offer government rate through their website or by phone reservation.

*****NOTE:** If you choose to stay in North Las Vegas, be aware that your travel time to Mercury is approximately 65 minutes (early morning, no traffic). Your travel time to DAF (Wednesday and Thursday mornings) is approximately 90 minutes.

Mercury Dorms

The NNSS does have dorm rooms available in Mercury. The rooms are standard motel-type rooms with internet access and cable TV. The Mercury cafeteria is the only option on-site for dining. With your badge, you can freely leave the site 24 hours a day. Emergency medical services are also available. Rooms are \$40 per night. The dorms can be booked by contacting Cindy Farinholt by email at cfarinholt@lanl.gov.

The dorms are located in Mercury and are a 30-minute drive from DAF.

Dosimeters and Radiation Doses

We will issue you a dosimeter on Monday morning. You must wear the dosimeter whenever you are in DAF. It should be worn above the waist with the window facing outwards. You will leave the dosimeters at DAF each night. We will collect the dosimeters on Thursday afternoon at the site. You will not need a dosimeter on Friday.

Radiation doses for the class are expected to be low. All critical experiments will be conducted in a shielded part of the facility to protect you from excessive doses. However, you will be handling fissile material, so you will receive some radiation dose. You will not receive more than 10 mrem during the entire week of the class, and your actual dose is likely to be much lower. At the end of the year, you will get a report of your dose from the NNSS contractor, NSTec, based on your dosimeter readings.

Daily Logistics

We want you as a student to have the most “hands-on” laboratory time as possible and to have a great educational experience. Since our experimental facility is fairly remote, the days will be accordingly long. Even though the morning start times are early, **please arrive on time each day**. If you do not arrive on time, we cannot guarantee that you will be able to participate in the day’s activities.

Monday

We will be meeting in at 7:15am at the Department of Energy’s Nevada Support Facility (NSF/NFO) badge office at 232 Energy Way, in Las Vegas. The NSF/NFO badge office visit will ensure you have access to DAF/NCERC for the week. A map on how to get to NSF/NFO is provided below. Class will

start at 8:00 and will be held in the Sedan conference room. A course POC will be at the badge office to assist with the badging process.

Tuesday, Wednesday, and Thursday

We will meet at 7:45 at the DAF Entry Guard Station (EGS) Tuesday, Wednesday, and Thursday. You will need to leave your hotel approximately 1-1.5 hour early (depending on where you are staying in Vegas) each day to make it to DAF on time. Experiments and lectures will be performed all day on Tuesday, Wednesday, and Thursday at the DAF. The course typically finishes at about 5:00 pm each day.

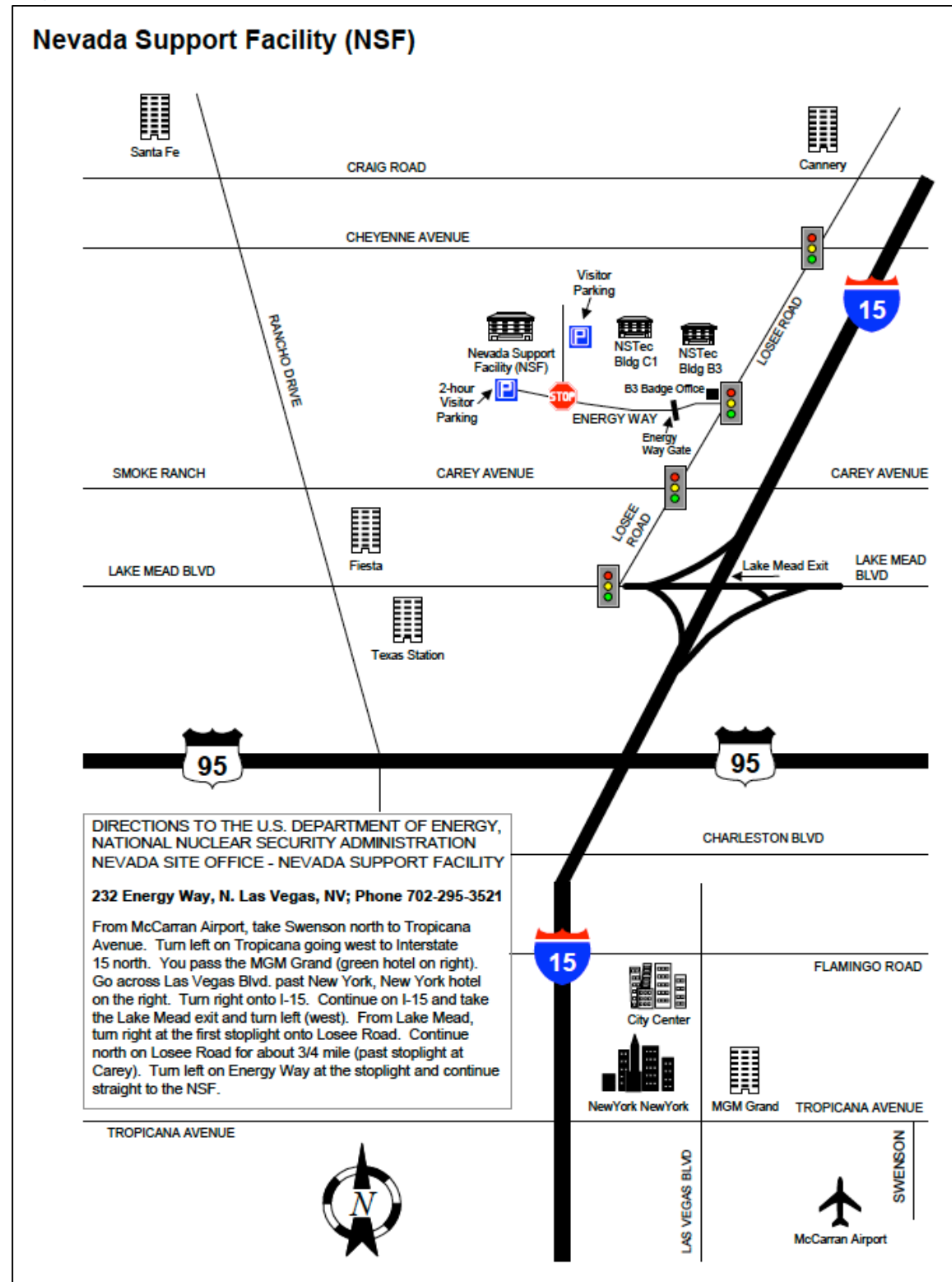
A map of the NNSS, Mercury, NV, and the DAF is provided below.

Bring a lunch and some snacks for breaks. No lunch will be provided.

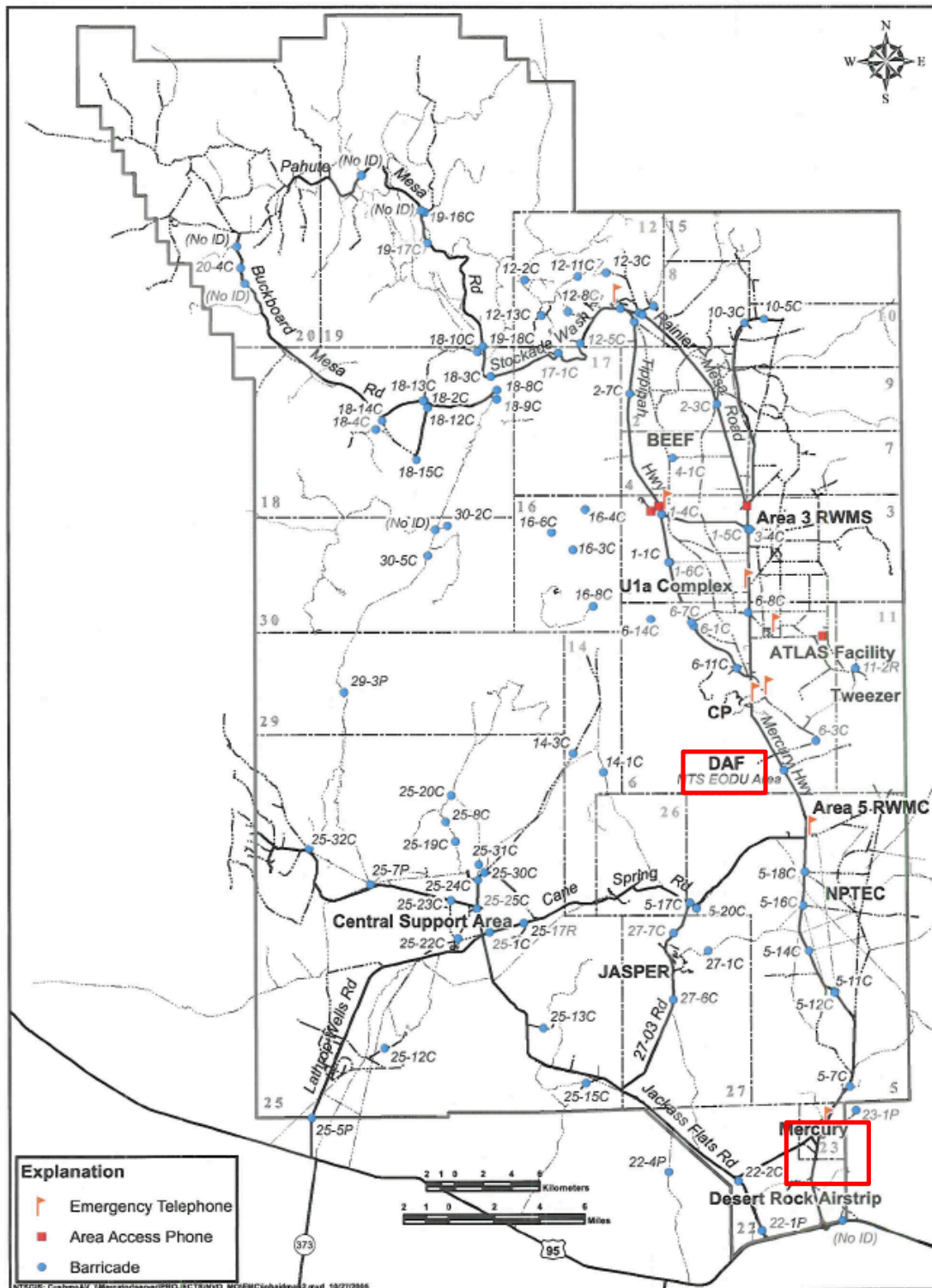
Friday

After a week of early mornings, Friday will be your day to sleep in (a bit!). We will be meeting in town, again, at 8:30 at the Department of Energy's Nevada Support Facility (NSF/NFO) at 232 Energy Way, in Las Vegas in the Sedan conference room. You will need your badge to get into NSF/NFO through the security check point.

Map of NSF/NFO



Map of the NNSS, Mercury, NV, and the DAF



**Nevada National Security Site Map.
Mercury and DAF are highlighted with red boxes.**